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Earlier studies found that recall scores of information central to the task increased with age while incidental information recall scores remained constant. This study repeated the earlier ones modifying procedures of instructions, testing, and schedule of recall. Also, it tested the effect of labeling pictorial stimuli. The sample of 253 children were to learn to discriminate either content or position of presented pictures as central information. The sample was divided by three age groups, 7 to 9, 10 to 11, and 12 to 14. These groups were further subdivided into four groups. The first group received more ambiguous directions than did the other groups. The second group was tested on a balanced schedule of recall. The third group was shown names of animals, while the fourth group was shown numbers designating positions of pictures. The results showed that (1) as before, content recall scores increase with age, (2) more ambiguous directions led to less selectivity at all ages, (3) a balanced schedule of recall was effective at an older age, (4) labeling depresses incidental information scores at all ages, and (5) name labeling is more effective than numerical labeling, but not at a significant level. A bibliography and tables are included. (JS)

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The University of Michigan

Center for Human Growth and Development

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Central and Incidental Learning in Children

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(Study C: Development of Selective Attention Abilities)

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Abstract

This experiment is one of a series of studies on the development of selective attention in children. A major finding of this experiment, as in the previous ones, was an increase with age of S of recall scores of information central to the task, while scores of incidental information did not increase with age, but remained more or less constant over a wide age range (7-14 years). There were two parts to this experiment; the first was designed to clarify some questions on the effects of variations in procedure which arose from two of the earlier studies. The results indicated that ambiguity of instructions, individual versus group testing, and time of recall measurement each had an effect on the recall scores of Ss. However, the major finding was stable throughout most of these variations. The second part of the experiment was intended to test the effect of labels attached to the pictorial stimuli. It was found that effects varied somewhat with age, type of label (picture name versus numeral designating position), and type of recall measured (central versus incidental task). However, the picture name labels consistently affected greater divergence between task-relevant and task-irrelevant recall scores, thus acting to increase the selectivity of attention at all three age levels. These results were discussed in relation to recent findings and hypotheses concerning verbal mediation.

Central and Incidental Learning in Children[1]

John W. Hagen and Ruth Sabo

The University of Michigan

A series of experiments on the development of selective attention (Maccoby and Hagen, 1965; Hagen, 1967; Hagen and Sabo, 1967; Druker, 1967) have shown a general trend for recall scores of information central to the task to increase with age of the S while recall scores of task-irrelevant (or incidental information) remain about the same or even decrease with increasing age. These studies indicate that as a child gets older he more effectively "divides his attention" -- devoting an increasingly larger proportion to the most relevant aspects of his environment, and in some manner filtering out the less relevant ones. What is uncertain, however, is the specific deficit in the child less than twelve years or so, and just where in the series of events which make up information processing the deficit occurs. It is to help answer these questions that this study was undertaken.

What are apparently slight variations in procedure from study to study appear to have been affecting results, although the basic finding that with increasing age there is a significant decline in the proportion of total information processed which is task-irrelevant appears quite stable. It occurred to us that if these variables were more carefully controlled they might provide some clues as to the processes underlying selective attention, and this, therefore, was the aim of the first part of this experiment.

The major problem arose in comparing the results of Hagen, and Hagen and Sabo. Ss in both studies were shown essentially the same pictorial stimuli. In the former study the position of the picture pair was always the central task, and the contents of the pairs was always the incidental. It was found that central recall scores increased with age, but incidental did not. In the latter study position of the pictures was the central task for half the children only; for the other half content of the pairs was the

central task. The results showed that the problem was more difficult for the former group than the latter. For both groups combined, and for the pairs group only, the results were similar to Hagen's study; but for the position group only they were not.

Any or all of three procedural variations might account for this difference, and it was decided to further investigate the effects of these variations. The first procedural difference was one in time of recall measurement. In Hagen there was no delay between presentation of central information and the recall test for that information, but there was a delay for incidental material. In Hagen and Sabo there was a counterbalanced delay for both types of information. The second difference was the administration of slightly different instructions in the two studies. The instructions in Hagen and Sabo were, compared to those in Hagen, somewhat more ambiguous, making less of a distinction between central and incidental tasks. The third variation was individual (Hagen) versus group (Hagen and Sabo) testing. It was predicted that the individual attention made the task somewhat easier for the children.

There were four experimental groups in the present experiment. Group I replicated Hagen and Sabo's group "set" for position (the group for which significant differences were not obtained), but the Ss were tested individually as in Hagen. Group II was a replication of Hagen (without distraction) with one modification: recall measurement for both central and incidental tasks came at the end of the entire experiment, the procedure used in Hagen and Sabo. The results obtained should clarify the question of why performance differed for the two groups which had position of the pictures as the central task. Also, the results of Group II should indicate whether the findings of Hagen could be replicated with the delayed recall measurement for both central and incidental scores.

The second part of the experiment was designed to test the effect of labels attached to the pictorial stimuli. Several studies have indicated that recall is facilitated when verbal labels are provided (Kurtz and Hovland, 1953; Bernbach, 1967; Hagen and Kingsley, 1967) and the selective attention paradigm provides a way to investigate further how such labels affect memory processes. Several questions arise: are different types of labels equivalent? do written labels affect central and incidental scores differentially? do they affect age groups differentially? Current literature proposes somewhat contradic-

tory hypotheses. Younger children's performance might be enhanced more than older because the older ones would be more likely to provide labels spontaneously (production-deficiency hypothesis, see Flavell, Beach, and Chinsky, 1966), or it could be hypothesized that older children might be helped more than younger ones because the latter might not be able to use the labels provided as mediators (mediation-deficiency hypothesis, see Reese, 1962). If labels do facilitate recall with any group it is probably because they increase the number of discriminative cues. However, it is possible that labels if not used in that manner, could add to the background noise, depressing performance levels as the distractors in previous studies have done (Maccoby and Hagen, 1965; Hagen, 1967).

Method

Subjects:

The Ss were selected from three different chronological age (C.A.) levels -- 7-9, 10-11, and 12-14 years, from children who participated in summer park recreational activities under the supervision of the Ann Arbor Recreation Department, Ann Arbor, Michigan. Approximately the same number of boys and girls was assigned to each age group. The Ss came from the same general population used in Hagen and Sabo, but the two studies did not use the same children. Because there was no information available pertaining to the intellectual abilities of the Ss, random selection was used in assigning children to different groups. A total of 253 Ss were tested.

Materials:

The stimulus pictures were the same black line drawings as those used in Hagen and Sabo, to which the interested reader can refer for further details. For Group III the name of each animal was printed in block letters directly on the picture of the animal, and for Group IV the number representing the position of each card, including any blanks, was printed on the border of each card. The materials used to test memory for pairs was the same for all groups and is exactly as described in Hagen and Sabo. The materials to test memory for position for Group I consisted of a row of seven blank cards and the seven pairs of stimulus pictures presented in a random order, as in Hagen and Sabo. For the

other three groups, however, the seven pairs of stimulus pictures were replaced with the seven animal pictures alone, i.e., without the household object pictures, as in Hagen.

Design:

There were four treatment groups within each of the three age levels. A central score and an incidental score were obtained from each S, the central being recall for position and the incidental recall for pairs. Each S had seven seconds to peruse each of the ten pages in the booklet. Groups I and II saw exactly the same stimuli, except during the recall test for position as described above; the instructional set given the two groups differed somewhat. Group I received the same instructions as in Hagen and Sabo, directing the Ss simply to learn position. Group II received the less ambiguous instructions which were used in Hagen, directing them to learn the position of the animals, implying that they were to ignore the household objects. Groups III and IV received the same instructions as II, but each of them also saw the labels described above on their cards.

Procedure:

Ss were tested individually, either in adjacent buildings, if they were available, or in a quiet section of the park itself. Otherwise, the procedure was the same as that described in Hagen and Sabo, except that Ss were allowed only seven seconds per page, there was one E for each S, and the E turned the pages in the booklet of the S.

Results

Figure 1 indicates that Group I, which replicated Hagen and Sabo's group set for position, performed more like the equivalent group in Hagen's study than in Hagen and Sabo's. Both age ($F = 3.21$, $p < .05$) and instructional set ($F = 8.75$, $p < .01$) were significant, replicating the steady increase with age in central recall scores, and curvilinear age trend in incidental scores. The Figure also reveals that the more ambiguous instructions which Group I heard resulted in less selectivity, that is, in a smaller difference between central and incidental recall scores at all age levels in comparison to

the other three groups. Group II* was the replication of Hagen's group without distraction, except that recall for both central and incidental tasks was measured at the same time -- i.e., at the completion of all stimuli presentations. As in the original study there was a significant effect of age level ($F = 3.71$, $p < .05$) and instructional set ($F = 23.30$, $p < .01$), but the significant interaction was not replicated. Thus, there was an effect due to the time of recall difference.

Insert Figure 1 about here

A two-way analysis of variance compared central scores for the four groups. The only significant factor was age level ($F = 12.07$, $p < .01$). Perusal of Figure 2, however, shows that Group III, which saw the animal names, had the highest central scores at all age levels, especially at ages 10-11. The significant age effect was obviously caused by the increase of central scores with increase in age. A similar analysis was performed for the incidental scores only. Here, as in past studies, age level was not significant. There was no significant rise in scores for older Ss as was found with task-relevant scores. The experimental group effect, however, was significant -- both for all four groups ($F = 9.90$, $p < .01$) and also for Groups II, III, and IV, only -- the three groups sharing identical instructions ($F = 3.16$, $p < .05$). Group II can be viewed as a control group because it was not exposed to labels but was in every other way identical to the other two groups. Inspection of Figure 2 shows that the effect of labeling is one of depression of incidental scores at the lowest and highest age levels.

Insert Figure 2 about here

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* A second Group II was tested since the data for the first group tested was very different from the group it was supposed to replicate and was also inconsistent with the other groups tested in terms of overall performance. Since the data for the second group (Group II*) was much more consistent with the several previous studies, it seems reasonable to conclude that some unknown spurious factors affected the first Group II (A). Both sets of data are presented for the reader, however.

Discussion

Results from the two replication groups, I and II, help to clarify previously unanswered questions, as well as lend reliability to the finding of a steady increase in central task scores with increased age but no such increase in incidental scores. As stable as this main finding appears, it is now obvious that such relatively minor variations as individual versus group testing or slightly altered instruction can influence performance in this selective attention paradigm. The failure of the position-as-central scores group in Hagen and Sabo to replicate the earlier finding of Hagen seems to be attributed to the increased difficulty of the task under group testing conditions. It was evident that of the two central tasks, learning positions or learning pairs, the former was intrinsically more difficult and when the children lost the benefit of individual testing, the difficulty of the task appeared to be too much for children of any age to cope with successfully. It was also shown that the basic finding of Hagen's can be replicated with both central and incidental tested after a delay; however, the failure to find an age-condition interaction in this study indicates that the two procedures do not produce identical results.

Although the effects of labels on central task scores did not reach significance, there was a trend for the animal names to facilitate scores. It had been expected that the name labels would facilitate selective attending more than the number labels, because the former provided a more relevant or "useful" cue. The graph indicates this: the animal names were facilitative on central scores but the numbers were not. It is interesting that the number group's (IV) central scores were depressed evenly across all age levels when compared with the control group (II). It thus appears that the number labels acted as the distractors did in the previous studies.

For the incidental scores the label effect was significant. Both kinds of labels depressed incidental scores at two of the three age levels, but at the third age level (10-11 years) scores for groups II, III, and IV were very similar.

It is now appropriate to return to the questions asked in the introduction. It appears that different labels act in different ways. Compared to the control group,

animal names increased central scores, although the increase was not a significant one. Number labels depressed central scores. But for the incidental scores, both types of labels acted similarly, significantly depressing recall scores for the youngest and the oldest group, compared to the control group without labels. Thus all three types of variables, age of children, type of recall measured (central versus incidental), and type of label are related to performance. However, an overview of Fig. 1 indicates that there is a single trend at least in the effects of the animal labels on this task. At ages ten to eleven, by enhancing central task recall, and at ages seven to nine and twelve to fourteen, by depressing incidental task recall, the labels consistently acted to increase the selectivity of attention in the Ss -- i.e., the two scores diverged the most under this condition as compared to other conditions.

There appears a remarkable correspondence between the facilitative effect of the written animal name on central scores in this study and the facilitative effect of oral animal names on recall scores in a recent study by Hagen and Kingsley (1968). There it was found that labels boosted recall scores in a similar task for their middle groups, C.A. six to nine, but did not for children younger or older. The lack of facilitation in the youngest children was interpreted as supporting the mediational deficiency hypothesis (Reese, 1962). They believe labels did not aid the older group because for them mediation is a "relatively automatic and covert process (p. 119)." But for the six to nine year old Ss mediation can occur and overt verbalization facilitated it. The same explanation can be invoked in this study, and the upward displacement of age levels might well be a function of the written nature of the animal names here versus the overt verbalization in Hagen and Kingsley.

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Footnote

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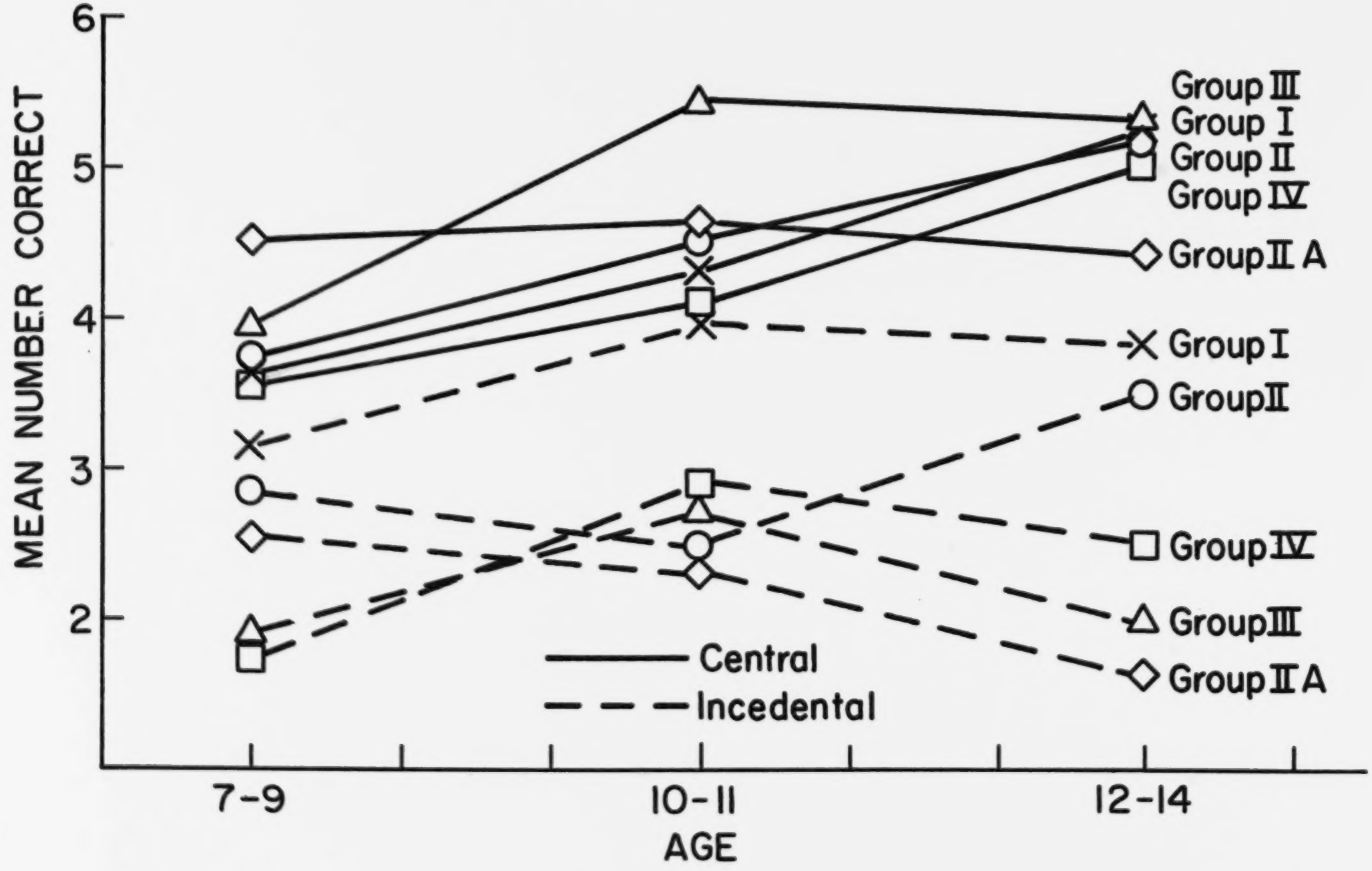
MEAN NUMBER CORRECT
6
5
4
3
2
7-9
10-11
12-14
AGE
Group III
Group I
Group II
Group IV
Group II A
Group I
Group II
Group IV
Group III
Group II A
Central
Incedental

Fig. 1

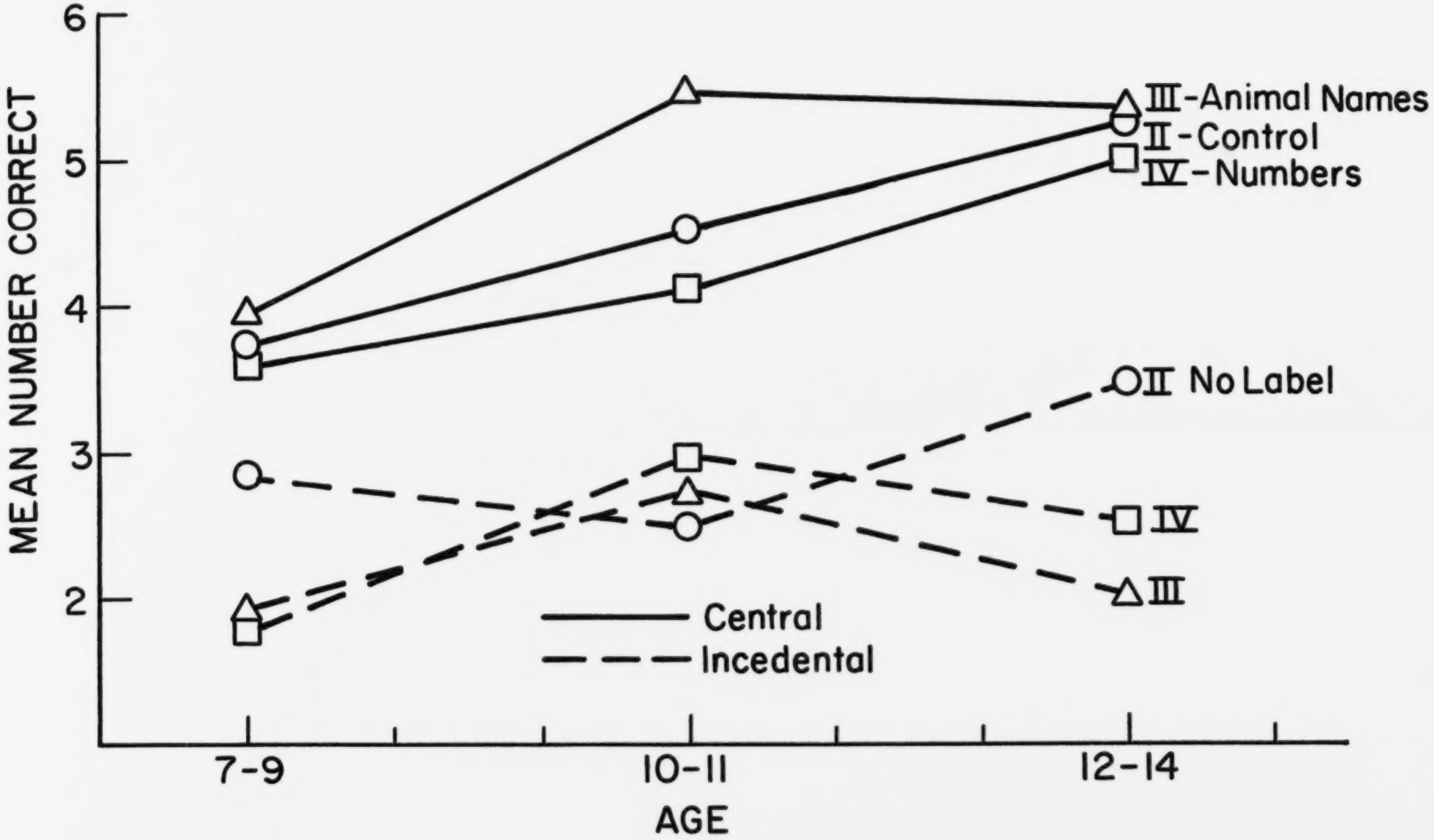
MEAN NUMBER CORRECT
6
5
4
3
2
III-Animal Names
II-Control
IV-Numbers
II No Label
IV
III
Central
Incedental
7-9
10-11
12-14
AGE

Fig. 2